EXHIBIT G

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION

WSOU INVESTMENTS LLC, D/B/A BRAZOS LICENSING AND DEVELOPMENT *Plaintiff,* v. ONEPLUS TECHNOLOGY (SHENZHEN) CO., LTD., *Defendant*.	Case No. 6:20-CV-00952-ADA Civil Action No. 6:20-00953-ADA Civil Action No. 6:20-00956-ADA JURY TRIAL DEMANDED

DECLARATION OF DR. TODOR COOKLEV IN SUPPORT OF PLAINTIFF'S RESPONSIVE CLAIM CONSTRUCTION BRIEF (GROUP I PATENTS)

I. Introduction

1. My name is Todor Cooklev, and I have been retained by Plaintiff WSOU Investments LLC ("WSOU").

2. I have been asked to prepare this Declaration in connection with the above captioned District Court actions, and have been asked to investigate and opine on issues relating to certain claim limitations of U.S. Patent No 8,149,776 ("the '776 patent") and 8,767,614 ("the '614 patent") (collectively, "Patents-in-Suit").

3. I have reviewed Defendant OnePlus's Opening Claim Construction Brief (Group I Patents). I submit this Declaration in support of WSOU's Responsive Claim Construction Brief. To the extent I do not specifically opine on something raised in OnePlus's Opening Claim Construction Brief, that does not mean I agree with the point or issue.

4. I base this Declaration on information currently available to me. I note that OnePlus has not submitted an expert Declaration in support of its Opening Claim Construction Brief. I reserve the right to respond should OnePlus submit a Declaration.

5. This Declaration addresses the following claim terms of the '776 patent:

Claim Term	WSOU's Proposed Construction	OnePlus's Proposed Construction
"[transmitter] attempting access to a wireless network" ('776 Patent, Claim 1) "transmitter configured to attempt access to a wireless network..." ('776 Patent, Claim 10)	Plain and ordinary meaning. This claim should not be construed under 35 U.S.C. 112, ¶ 6, nor is it indefinite.	This claim should be construed under 35 U.S.C. 112, ¶6. Function: attempting access to a wireless network by sending a signature sequence on a random access channel.

		Structure: none disclosed The claim is indefinite.
"processor" ('776 Patent, Claims 10, 11, 12, 14, 15, 16, 18, 19)	Plain and ordinary meaning. This claim should not be construed under 35 U.S.C. 112, ¶ 6, nor is it indefinite.	This claim should be construed under 35 U.S.C. 112, ¶6. Functions: determining that access attempts are unsuccessful. Structure: none disclosed The claim is indefinite.
"program of instructions" ('776 Patent, Claim 19)	Plain and ordinary meaning. This claim should not be construed under 35 U.S.C. 112, ¶ 6, nor is it indefinite.	Preamble limiting; this claim should be construed under 35 U.S.C. 112, ¶6. Function: attempting access to a wireless network by sending a signature sequence on a random access channel. Structure: none disclosed The claim is indefinite.

6. This Declaration addresses the following claim terms of the '614 patent:

Claim Term(s)	WSOU's Proposed Construction	OnePlus's Proposed Construction
"means for causing sending of a buffer information report to a system station" ('614 Patent, Claim 6) "at least one processor; and at least one memory including computer program code the at least one memory and the computer program code	These terms are not indefinite. No construction necessary – plain and ordinary meaning. Claim 13 should not be construed under 35 U.S.C. 112, ¶ 6. To the extent the Court treats the terms as	This claim should be construed under 35 U.S.C. 112, ¶6. Function: attempting access to a wireless network by sending a signature sequence on a random access

configured to, with the at least one processor, cause the apparatus ... sending of a buffer information report to a system station"	means-plus-function: Function: "for causing sending of a buffer information report" Structure: processor and memory Refer 6:4-9	channel. Structure: none disclosed The claim is indefinite.
"means for causing sending of an indication to the system station" ('614 Patent, Claim 6) "at least one processor; and at least one memory including computer program code the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus . . . sending of an indication to the system station" ('614 Patent, Claim 13)	These terms are not indefinite. No construction necessary – plain and ordinary meaning. Claim 13 should not be construed under 35 U.S.C. 112, ¶ 6. To the extent the Court treats the terms in claims 6 and/or 13 as means-plus-function: Function: "for causing sending of an indication to the system station" Structure: processor and memory Refer 6:4-9	This claim should be construed under 35 U.S.C. 112, ¶6. Functions: determining that access attempts are unsuccessful. Structure: none disclosed The claim is indefinite.
"the at least one memory and the computer program code are further configured to, with the at least one processor, cause the apparatus to perform at least the following: process an indication that the buffer size of the node for relaying is extended from that of the user equipment and information of the size of the extension" ('614 Patent, Claim 14)	Plain and ordinary meaning: This claim should not be construed under 35 U.S.C. 112, ¶ 6, nor is it indefinite. If the Court deems a construction is necessary: "the at least one memory and the computer program code are further configured to, with the at least one processor,	Preamble limiting; this claim should be construed under 35 U.S.C. 112, ¶6. Function: attempting access to a wireless network by sending a signature sequence on a random access channel. Structure: none disclosed

	cause the apparatus to perform at least the following: process a signal signifying that the buffer size of the intermediate node is extended from that of the user equipment and information of the size of the extension"	The claim is indefinite.

II. Qualifications

7. I am currently professor of electrical and computer engineering at Purdue University in Fort Wayne, Indiana, where I have had several administrative and faculty appointments.

8. I received a Doctor of Philosophy (Ph.D.) degree in Electrical Engineering from Tokyo Institute of Technology in Tokyo, Japan in 1995.

9. I have authored and co-authored more than 100 peer-reviewed articles. I am also a named inventor on 32 U.S. patents. For part of this work in 1999 I was inducted into the Purdue Inventors Hall of Fame A list of my publications and patents appears in my curriculum vitae attached as Appendix 1. A significant number of my publications pertain to image and video processing and compression. I teach several courses related to signal processing.

10. I have received research funding from the National Science Foundation (NSF), the Defense Advanced Research Projects Agency (DARPA), the U.S. Air Force Research Laboratory, the Office of Naval Research, and a number of private companies,

including major technology companies.

11. In addition to my academic experience I have experience in technology and product development in industry. My work has been in digital signal processing, software, and integrated circuit design for communication systems.

12. I have contributed to the development of several major standards for communication systems and numerous amendments. I have participated in many meetings of standards committees. I have prepared, submitted, and presented documents relating to technical matters considered by these committees.

13. As part of my long record of service to IEEE, I served as Chairman of the IEEE Standards in Education Committee. In 2020, I was elected to serve on the Board of Governors of the IEEE Standards Association for one term beginning January 2021. The Board of Governors provides overall leadership of the IEEE Standards Association. Also, I am the Series Editor for Wireless and Radio Communications for the IEEE Communications Standards Magazine (which is the premier journal in the field of communication standards) and have held that position since 2017.

14. I am qualified by education and experience to testify as an expert with respect to subject matter in the fields of communication protocols, wireless transmission, wireless device hardware and software, and image and video processing and compression.

15. I have previously prepared expert reports and testified in a number of cases concerning. A list of the cases in which I have served as an expert is included in my *curriculum vitae*, which is attached hereto as Appendix 1.

III. Materials Considered

16. In forming my opinions expressed in this declaration, I have considered and relied upon my education, background, and experience. I reviewed the Patents-in-Suit and their file histories.

17. I have also reviewed and relied upon the additional materials cited in this declaration (*see infra*, page 22). These materials would have been available to a person of skill in the art prior to the relevant priority dates of the Patents-in-Suit and would have been relied upon and consulted by a person of skill in the art in the ordinary course of their work.

IV. Applicable Legal Standards

18. I understand that a patent specification is required to conclude with one or more claims that particularly point out and distinctly claim the subject matter that the patent applicant regards as his invention. This requires that a patent's claims, viewed in light of the specification and prosecution history, inform a person of ordinary skill in the art about the scope of the invention with reasonable certainty.

19. I understand that terms within a patent claim should be given their plain and ordinary meaning to a person of ordinary skill in the art at the time of the invention. I understand that the plain and ordinary meaning is determined from the language of the claims, the written description, and the prosecution history of the patent at issue. I understand that an inventor can act as his or her own lexicographer, ascribing a specific meaning to claim terms.

20. I understand that an element in a patent claim may be expressed as a means

for performing a specified function without reciting structure, which is referred to as "means-plus-function" claiming. I understand that when a patentee engages in means-plus-function claiming, the claim is construed to cover the corresponding structure described in the specification for performing the claimed function, and equivalents of that structure.

21. I understand that applying a "means-plus-function" analysis is a two-step process. The first step is to determine whether a claim is drafted in means-plus-function format. The question at this step is to determine whether the claim limitation connotes sufficiently definite structure to a person of ordinary skill in the art, which requires consideration of the specification among other evidence. If the limitation is in means-plus-function format, the second step is to specifically review the specification for the corresponding structure.

22. I understand that when a claim term lacks the word "means," it creates a presumption that the claim term is not in means-plus-function format. This presumption can only be overcome if the claim fails to recite sufficiently definite structure or merely recites a function without reciting sufficient structure for performing that function.

23. I understand that a limitation has sufficient structure when it recites a claim term with a structural definition that is either provided in the definition or generally known in the art. Structure may also be provided by describing the claim limitation's operation, such as its input, output, or connections.

24. I understand that for computer-implemented claims, structure differs from

more traditional, mechanical structure. Instead, the structure for such claims is understood through, for example, an outline of an algorithm, a flowchart, or a specific set of instructions or rules.

25. Even if the patentee uses a generic or nonce word, a proper construction of the claim in view of the specification and other intrinsic evidence may still provide sufficient structure to maintain the presumption against means-plus-function claiming. I therefore understand that if a limitation recites a term with a known structural meaning, or recites either a known or generic term with a sufficient description of its operation, the presumption against means-plus-function claiming remains intact.

V. <u>Level of Ordinary Skill in the Art</u>

26. A person of ordinary skill in the art at or before the time of the inventions of the Patent-in-Suit would have had a bachelor's degree in electrical engineering with 2-3 years of experience in the field of signal, image, and video processing and compression.

27. I am familiar with the knowledge and capabilities of one of ordinary skill in this area based on my experience working with engineers in the computer networking and data communications industry at the time of invention and also based on my experience working with undergraduate and graduate students. In addition, I personally met this definition of a person of ordinary skill in the art at the time of invention and the opinions offered herein are from the viewpoint of a person of ordinary skill in the art .

VI. <u>Background of the Technology</u>

28. Wireless communications networks that divide the service area into

relatively small geographic cells are called "cellular." A cell is an area that is serviced by a single cell site (also referred to as a base-station (or in LTE, eNodeB or eNB)). Devices (also referred to as user equipment (UE) or terminals), such as mobile phones or tablets operating within this geographic area, use that base station to communicate. Cellular networks distinguish between uplink (terminal to base station) and downlink (base station to terminal) traffic

29. Cells can have different sizes, depending on the expected number of users per cell. Generally, in densely populated urban centers, cells are smaller, of about 1 km (0.62 miles). Larger cells, sometimes on the order of 100 km (62 miles), are used in rural areas.

30. To allow all UEs with no existing connections with the eNB to establish communications, the network determines in advance certain time slots in which UEs may initiate "random access" ("RA")—i.e. transmissions that are not scheduled in advance. The RA Procedure generally comprises 4 transmissions between the UE and the eNB:

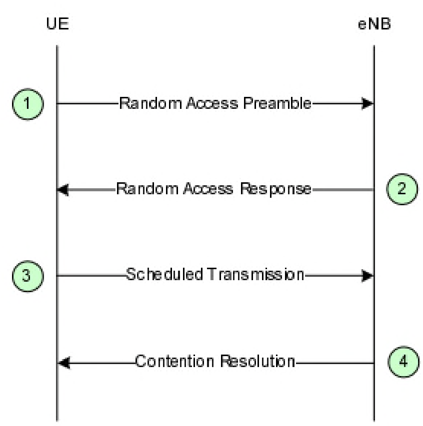

Figure 10.1.5.1-1: Contention based Random Access Procedure

See TS 36.300 V8.7.0 § 10.1.5.1

31. Random Access procedures can occur for a number of reasons, for example when the UE initially powers up, or has not accessed the network for a certain period of time, etc. Further, the UE can employ a RA procedure if it has data to send and does not have any radio resources to send it.

32. Because the random access procedure is so critical for the performance of LTE, the first message ("Msg1") uses the specially allocated Physical Random Access Channel ("PRACH") for transmission. 3GPP TS 36.300 V8.7.0 (2008-12), titled "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2," § 10.1.5.1. Msg1 contains the random access preamble sequence, which is randomly selected by the UE.

33. To serve requesting terminals, the LTE standard mandates that each eNB allocate 64 preambles. TS 36.321 V9.3.0 (2010-06), titled "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification," § 5.1.1.

34. In LTE the preamble sequence is a specially designed Zadoff-Chu sequence. Specifically, the Zadoff Chu sequences have (1) constant amplitude, and (2) zero cyclic autocorrelation. TS 36.211 V8.3.0 (2008-5), titled "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation;" TS 36.213 V8.3.0 (2008-05), titled "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Layer

Procedures" § 5.7.2. This means that multiple sequences can be sent at the same time by a number of UEs without the transmissions causing interference with each other. Thus, the number of UEs that can successfully conduct a RA procedure at any given time is increased.

35. The power used for the transmission of the RA preamble, together with other parameters required for RA, is determined by higher layers, i.e. layers above the physical layer.

36. If the UE receives no response, or no proper response, it considers the RA attempt unsuccessful. The RA procedure can fail for a number of reasons. When the preamble transmission fails, the UE will make another attempt.

37. Mobile devices do not have automatically the right to transmit. They need to be assigned time-frequency resources in which to transmit. A base station tries to assign resources to mobile devices that have data to send. To accomplish this, a base station needs to know which devices have data to send. In LTE mobile devices send buffer status reports (BSR) to the base station to provide it with information about the amount of data available for transmission.

VII. Construction of the Disputed Terms

A. The '776 patent

1. "[transmitter] attempting access to a wireless network" ('776 Patent, Claim 1)

"transmitter configured to attempt access to a wireless network…" ('776 Patent, Claim 1 10)

38. Defendant OnePlus asserts that the term "transmitter" has no structural meaning and that this term is indefinite. I disagree.

39. The term "transmitter" is a commonly used and well-understood term in the art that connotes structure to a person of ordinary skill in the art, who would understand a "transmitter" to refer to a combination of hardware and software that is capable of transmitting a signal.

40. The claims inform a person of ordinary skill in the art how the "transmitter" would interact with other components to achieve the recited functionality.

41. In addition, the '776 patent's specification and figures disclose the corresponding structure for a "transmitter" for attempting access to a wireless network. The specification explicitly recites "…[a]n apparatus that includes a processor and a transmitter." *See* '776 patent at 2:57-58.

42. Figures 3 and 4 illustrate how a preamble sequence and power for the transmission of a preamble sequence are chosen according to the '776 patent. FIG. 5 is a logical flow diagram that illustrates the execution of computer program instructions. Figure 5 defines a structure, in the form of an algorithm, for the operation of the claimed transmitter.

43. Figs. 6A and 6B depict high-level hardware architectures of electronic devices "…[t]hat are suitable for use in practicing the exemplary embodiments of this invention" *See* '776 patent at 10:19-12:45.

44. Fig. 6A illustrates "… [a] suitable radio frequency (RF) transceiver 10D". '776 patent at 10:32. A person of ordinary skill in the art would have understood that a transceiver is composed of a transmitter and a receiver, and consequently, the transceiver 10D includes a transmitter.

45. Figures 6B illustrates that multiple transmit/receive antennas can be part of the transmitter. Other hardware elements that are identified in Figure 6B are "power chip," "RF chip," "BB chip," etc. A person of ordinary skill in the art would have understood that these hardware elements can be part of the "transmitter." The transmitter is also connected to the rest of the device via the main processor, as conceptually illustrated in Figure 6B.

46. The specification also recognizes that some or all of the chips can be combined into a single chip.

> Note that the various chips (e.g., 38, 40, 42, etc.) that were described above may be combined into a fewer number than described and, in a most compact case, may all be embodied physically within a single chip.

'776 patent, 12:32-35.

47. In addition to the structure described in the specification and the figures, the "transmitter" claim limitation itself provides further structure by defining the operation of the claimed "transmitter," that "it is configured to attempt access to a wireless network."

48. The random selection of a signature sequence is performed by the mobile device. See, e.g., '776 patent at 5:62-6:17.

49. In my opinion, a person of ordinary skill in the art would find sufficient structure for the "transmitter" claim terms in the claims, specification, and figures of the '776 patent to carry out the functionality recited in the claims, and would be reasonably certain about the meaning and scope of these claim terms.

2. "processor" ('776 Patent, Claims 10, 11, 12, 14, 15, 16, 18, 19)

50. Defendant asserts that the term "processor" has no structural meaning and that this term is indefinite. I disagree.

51. The term "processor" is a commonly used and well-understood term in the art that connotes structure to a person of ordinary skill in the art, who would understand a "processor" to refer to a hardware and/or software component of an electronic device that is capable of executing instructions.

52. The claims inform a person of ordinary skill in the art how the "processor" would interact with other components to achieve the recited functionality.

53. In addition, the patent's specification and figures disclose the corresponding structure for a "processor" in the form of algorithms. FIG. 5 is a logical flow diagram that illustrates the execution of computer program instructions. Figure 5 defines a structure, in the form of an algorithm, that is executed by the claimed processor.

54. Figures 6B identifies several "chips" such as "power chip," "RF chip," "BB chip," etc. Some of these chips such as the "BB chip" can also be part of the claimed processor.

55. The '776 patent specifies that the claimed processor "… [m]ay be of any type suitable to the local technical environment, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on a multicore processor architecture, as non-limiting examples." See '776 patent at 11:15-19.

56. In addition to the structure described in the specification and figures, the claims themselves provide further structure by defining the operation of the claimed "processor": for example, "configured to determine that the access attempt from the first preamble was unsuccessful" and "causing the transmitter to send on the random access channel at a second transmit power a second preamble." See '776 patent at claim 10; *see also id*. at claims 11, 12, 14, 15, 16, 18 (all reciting "wherein the processor is configured to …" or "wherein the processor is further configured to …")

57. In my opinion, a person of ordinary skill in the art would find sufficient structure for the claim term "processor" in the claims, specification, and figures of the '776 patent to carry out the functionality recited in the claims, and would be reasonably certain about the meaning and scope of this claim term.

3. "program of instructions" ('776 Patent, Claim 19)

58. Defendant asserts that the term "program of instructions" has no structural meaning and that this term is indefinite. I disagree.

59. The term "program of instruction" is a commonly used and well-understood term in the art that connotes structure to a person of ordinary skill in the art, who would understand a "program of instructions" to refer to software containing a set of instructions that, when executed by a processor, carry out a task.

60. The claim informs a person of ordinary skill in the art how the "programs of instructions" would interact with other components to achieve the recited functionality.

61. In addition, the patent's specification and figures disclose the corresponding structure for a "program of instructions" in the form of algorithms. FIG. 5 is a logical flow diagram that illustrates the execution of computer program instructions. Figure 5 defines a structure, in the form of an algorithm, for the operation of the claimed "program of instructions".

62. The program of instructions is stored in a "computer-readable memory." See '776 patent at 3:4.

63. Further, the specification describes the actions when the program of instructions is executed. These actions correspond to the flowchart in Fig. 5. These actions describe structure in the form of an algorithm:

> when executed by a processor result in actions that comprise: attempting access to a wireless network by sending on a random access channel at a first transmit power a first preamble comprising a signature sequence that is randomly selected from a set of signature sequences; and responsive to determining that the access attempt from

> sending the first preamble was unsuccessful, re-attempting access to the wireless network by sending on the random access channel at a second transmit power a second preamble comprising a signature sequence, in which the second transmit power is no greater than the first transmit power.

See '776 patent at 3:5-16.

64. In my opinion, a person of ordinary skill in the art would find sufficient structure for the claim term "program of instructions" in the claims, specification, and figures of the '776 patent to carry out the functionality recited in the claims, and would be reasonably certain about the meaning and scope of this claim term.

B. The '614 patent

1. "means for causing sending of a buffer information report" ('614 Patent, Claim 6)

"at least one processor; and at least one memory including computer program code the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus … sending of a buffer information report to a system station" ('614 Patent, Claim 13)

65. Defendant OnePlus asserts that these two claim terms (one in claim 6, and the other in claim 13) have no structural meaning and are indefinite. I disagree.

66. First, with respect to the disputed phrase in claim 13, which does not recite the word "means," the claim connotes structure for this phrase, including the terms "computer program code," "processor," and "memory," to a person of ordinary skill in the art. These are all commonly used and well-understood terms with structural meaning in the art.

67. A person of ordinary skill in the art would understand "computer program code" to refer to software containing a set of instructions that, when executed by a processor, carry out a task.

68. As discussed above, a person of ordinary skill in the art would understand a "processor" to refer to a hardware and/or software component of an electronic device that is capable of executing instructions.

69. A person of ordinary skill in the art would understand a "memory" to refer to a hardware component of an electronic device that is capable of storing information, such as computer program code.

70. The claim informs a person of ordinary skill in the art how these components would interact with one another to achieve the recited functionality.

71. In addition, the specification and figures disclose the corresponding structure—a processor and memory— for the disputed claim phrases in claims 6 and 13. For example, column 6, lines 4-9, of the specification describe Figure 3, which depicts a controller apparatus having at least one memory and processor to provide the desired control functionality:

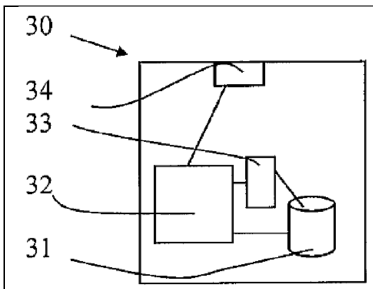

Fig. 3

FIG. **3** shows an example of a controller apparatus **30** for a relay node comprising at least one memory **31**, at least one data processing unit **32** and an input/output interface **34**. The control apparatus further comprises a buffering entity **33**. The controller may be configured to execute an appropriate software code to provide the desired control functionality.

72. In addition, Figure 4 (reproduced below) depicts a flow chart for reporting buffer information using the control apparatus, which would show a person of ordinary skill in the art the operations involved in generating a buffer information report based on a buffer report format used by at least one user station, the content of the report, and sending the buffer information report to a serving base station from a relay node, as claimed in the patent. *See* '614 patent at 4:50-51, 7:5-52.

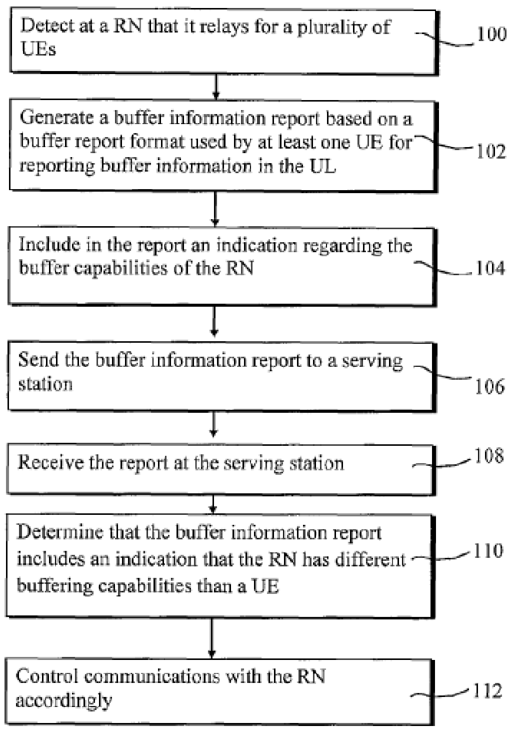

Fig. 4

73. Other parts of the specification describe the functions and interactions of the processor and memory to achieve the functionality recited in the claims. For example, the specification states:

> The required data processing apparatus and functions of a relay node and a base station apparatus in the system side as well as an appropriate user device may be provided by means of one or more data processors. The above described functions may be provided by separate processors or by an

> integrated processor. The data processing may be distributed across several data processing modules. A data processor maybe provided by means of for example, at least one chip. Appropriate memory capacity can also be provided in the relevant nodes. An appropriately adapted computer program code product or products may be used for implementing the embodiments, when loaded on an appropriate data processing apparatus, for example in a processor apparatus 13 associated with the base station 20 shown in FIG. 1 as an example of a serving station and the apparatus of FIG. 3 for a node for relaying.

’614 patent at 10:11-26.

74. In my opinion, a person of ordinary skill in the art would find sufficient structure for the disputed claim terms of claims 6 and 13 in the claims, specification, and figures of the ’614 patent to carry out the functionality recited in the claims, and would be reasonably certain about the meaning and scope of these claim terms.

2. “means for causing sending of an indication to the system station” (’614 Patent, Claim 6)

“at least one processor; and at least one memory including computer program code the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus . . . sending of an indication to the system station” (’614 Patent, Claim 13)

75. Defendant OnePlus asserts that these two claim terms (one in claim 6, and the other in claim 13) have no structural meaning and are indefinite. I disagree.

76. First, with respect to the disputed phrase in claim 13, which does not recite the word “means,” the claim connotes structure for this phrase, including the terms “computer program code,” “processor,” and “memory,” to a person of ordinary skill in the art. As discussed above in the previous section, these are all commonly used and well-understood terms with structural meaning in the art. Claim 13 informs a person

of ordinary skill in the art how these components would interact with one another to achieve the recited functionality.

77. As also discussed above in the previous section, the specification and figures disclose the corresponding structure—a processor and memory— for the disputed claim phrases in claims 6 and 13. *See* '614 patent at 6:4-9 (describing Figure 3, which depicts a controller apparatus having at least one memory and processor to provide the desired control functionality). Other parts of the specification provide additional details about the components' interaction, including to send an indication to the system station that the relay node has different buffering capabilities than the user station. *See, e.g.*, '614 patent at Fig. 4, 4:50-51, 7:5-52, 10:11-26.

78. In my opinion, a person of ordinary skill in the art would find sufficient structure for the disputed claim terms of claims 6 and 13 in the claims, specification, and figures of the '614 patent to carry out the functionality recited in the claims, and would be reasonably certain about the meaning and scope of these claim terms.

3. "process an indication that the buffer size of the node for relaying is extended from that of the user equipment and information of the size of the extension" ('614 Patent, Claim 14)

79. I understand that OnePlus contends that the phrase "process an indication" in claim 14 is indefinite because the word "process" lacks reasonable certainty. I disagree.

80. "Process" is a well-understood and widely used verb in electrical and computer engineering, as reflected by a variety of technical dictionaries. The IEEE

defines process to mean "To perform operations on data."[1] IBM similarly defines process to mean "To perform operations on data in a process."[2] American Heritage defines "process" to mean "To perform an operation, such as sorting or calculating, on data."[3] Oxford University defines "process" to mean "To carry out the actions defined by the sequence of instructions that make up the code of a program.").[4]

81. A person of ordinary skill in the art would understand from the express language of claim 14 and common parlance that "process an indication" refers to the apparatus (which has at least one processor) processing an indication by taking the information about buffer size into account and performing operations on the data. In the context of claim 14, the information that the apparatus would take into account and perform operations on would be "an indication that the buffer size of the node for relaying is extended from that of the user equipment and information of the size of the extension."

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[1] INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, THE IEEE STANDARD DICTIONARY OF ELECTRICAL AND ELECTRONIC TERMS 821 (6th ed. 1997) ("**process** … **(2)** … **(C)** (software) To perform operations on data."). [Exhibit H]

[2] GEORGE MCDANIEL, INTERNATIONAL BUSINESS MACHINES, IBM DICTIONARY OF COMPUTING 532 (McGraw-Hill, 10th ed. 2004) ("**process** … **(5)** To perform operations on data in a process."). [Exhibit I]

[3] AMERICAN HERITAGE, DICTIONARY OF COMPUTER AND INTERNET WORDS 222 (Houghlin Mifflin Co. 2001) ("**process** … ***v*****.** To perform an operation, such as sorting or calculating, on data."). [Exhibit J]

[4] OXFORD UNIVERSITY PRESS, DICTIONARY OF COMPUTING 399 (6th ed. 2008) ("**process** … **2.** To carry out the actions defined by the sequence of instructions that make up the code of a program."). [Exhibit K]

82. The specification provides further details about the apparatus "processing" information by communicating and taking into account information about buffer size for processing. *See, e.g.*, '614 patent at 6:62-7:1, 7:18-22, 7:30-41.

83. In my opinion, a person of ordinary skill in the art would be reasonably certain about the meaning and scope of the phrase "process an indication" in claim 14 in light of the claim language and specification.

I declare under penalty of perjury that the statements made in this Declaration are based on my own knowledge and that all opinions given are my own.

Dated: September 14, 2021

Dr. Todor Cooklev

Appendix 1

Curriculum Vitae

Todor Cooklev, PhD.

Curriculum Vitae

Personal

1336 Sycamore Hills Parkway, Fort Wayne, IN 46814
Contact e-mail: tcooklev@gmail.com
Cell: 925-984-5283

Citizenship: United States (by naturalization)

Professional experience

2016 – **Professor of Electrical and Computer Engineering**
Purdue University Fort Wayne, Indiana

- Research on most aspects of wireless systems, including hardware, signal processing, and software techniques, in particular for software-defined radios.
- Courses:
  ECE 428 Communication Systems
  ECE 549 Software-Defined Radio
  ECE 543 Wireless Communications and Networks

2010 – 2016 **ITT Associate Professor of Wireless Communication and Applied Research,** *Purdue University Fort Wayne*

2008 – **Director, Wireless Technology Center**
Purdue University Fort Wayne

2005 – 2008 **Consultant, Hitachi America Ltd., San Jose, California**

- Voting Member, IEEE 802.11 WG; participated in the work on several 802.11 amendments
- Chair, IEEE 802.11 VTS Study Group; responsible for the proposal and approval to create a Task Group that lead to the IEEE 802.11aa standard

2011 – 2012 **Consultant, Hitachi America Ltd., San Jose, California**

- Attended meetings of the 3GPP RAN1 standardization committee in Dresden, Germany, Jeju Island, Korea, Prague, Czech Republic, and Qindao, China, 2012.
- Contributed to several documents submitted to 3GPP

2006 – 2008 **Consultant,** *Datamars, Lugano, Switzerland*

- Evaluated and produced reports on certain wireless technologies and standards
- Participated in the IEEE 802.15.4f committee

2004 – 2006 **Consultant,** *Leica Geosystems, Switzerland*

- IEEE 802.16 (WiMAX) and related technologies

2005 – 2007 **Technical Advisory Board Member**, *Doceotech, San Ramon, CA*

2002 – 2008 **Assistant Professor** with tenure (2008), *San Francisco State University.*

2000 – 2002 **Member of the Technical Staff**, *Aware, Inc., Bedford, MA and Lafayette, CA*

- Worked on DSL standards. Participated in the International Telecommunications Union, Study Group 15, Question 4. Chaired the session on coding for DSL at the session in Antwerp, Belgium, June 2000. Participated in the Telecommunications Industry Association T1E1 Committee on DSL
- Developed advanced coding and decoding methods for DSL
- Worked on the design of an IEEE 802.11a chipset.
- Voting member, IEEE 802.15; Co-Founder and First Vice-Chair of IEEE 802.15.3 (High-data rate wireless personal area networking

1998-1999 **Consultant**, *Quantronix, Framingham, Utah*

- Image processing; developed software for edge detection and wrote a report

1996-1997 **Consultant,** *Communications Research Center, Government of Canada.*

- Designed digital filter banks for communication systems and wrote two technical reports

1996-1999 **Senior Engineer,** *3Com Corporation*

- Worked on V.90 voice-band modems
- Implemented data compression and other signal processing algorithms V.42 and V.42bis
- Worked on the Bluetooth Standard, one of the first contributors to the Host Controller Interface of Bluetooth.
- Participated in the Bluetooth/IEEE group, which drafted the license agreement between Bluetooth and the IEEE 802, which in turn led to the establishment of the IEEE 802.15 Working Group.

Grants Awarded

1. Office of Naval Research Summer Fellow 2020, Naval Surface Warfare Center Crane
2. National Science Foundation S^2ERC I/UCRC, “FPGA implementation of shared-memory middleware”, 2017-2019, PI
3. National Science Foundation S^2ERC I/UCRC, “Shared-memory middleware”, 2016-2017, PI
4. City of Fort Wayne, Economic Development Fund, 2013-15, co-PI.
5. Allen County Capital Improvement Board (CIB), 2013-15, co-PI

6. U.S. Defense Advanced Research Projects Agency (DARPA) Small Business Technology Transfer (STTR) Phase I "A flexible and extensible solution to incorporating new RF devices and capabilities into EW/ISR networks, co-PI, August 2013 – February 2014.

7. National Science Foundation S^2ERC I/UCRC, "The performance of middleware solutions for SDR", 2013-2014, PI

8. National Science Foundation S^2ERC I/UCRC, "Cognitive decision applications for embedded use," 2011-2012, PI

9. Visiting Fellowship, National Institute of Communication Technology (Japan), 2011

10. National Science Foundation S^2ERC I/UCRC, "Signal processing techniques for multicarrier modulation," 2009-2011, PI

11. NMDG, Belgium, laboratory grant 2010, PI

12. National Science Foundation, Professional Science Master's Program, MS in engineering, with concentration in wireless and systems engineering, 2010-2013, Co-PI.

13. Emona Instruments, Sydney, Australia, Laboratory exercises in communications, Principal Investigator, 2008.

14. Lilly Endowment, wireless laboratory grant, 2010, PI.

15. ITT (now Harris) Communications Systems, 2007-2011, PI.

16. State of Indiana, workforce development, 2008-2010, PI

17. National Science Foundation DUE-0442313, "Standards in Education for Product, Process, and Service Design and Development: A Proof-of-Concept Project," 2005-2008, PI.

18. France Telecom, Paris, France, "New methods for multicarrier modulation for high data-rate wireless systems," Principal Investigator, 2006.

19. Agilent Technologies/Sun Microsystems, Palo Alto, CA, "Distributed wireless sensor network for environmental monitoring," Co-principal Investigator, 2005.

20. CSU summer research grant, 2004.

21. U.S. Air-Force Research Laboratory, Wright-Patterson AFB, "Data over voice communications," Principal Investigator, 2004.

Honors and Awards

2012	IEEE Standards Association, "for outstanding contributions to the development of IEEE 802.11aa"
2006	Wireless Educator of the Year Award with the citation "In recognition of the pivotal role of educators in preparing tomorrow's wireless technology leaders".
2005	Duke's Choice Award, Sun Microsystems, (group award)
2003	IEEE Communications Society Oakland/East Bay Chapter Achievement Award, (group award)
1999	3Com Inventor Award
1995-1997	NATO Science Fellowship
1994	IEEE Asia - Pacific Conference on Circuits and Systems Best Paper Award for the paper "Theory of filter banks over finite fields"

Education

1995 *Tokyo Institute of Technology, Tokyo, Japan,*
Doctor of Philosophy in Electrical Engineering
Dissertation: Regular Perfect-Reconstruction Filter Banks and Wavelet Bases

1988 *Technical University of Sofia, Bulgaria,* Dipl. Eng. in Electrical Engineering

Professional Activities

Board Membership:
Board of Governors, IEEE Standards Association, 2021-2022

Committee/Editorial Board Membership:
IEEE Communications Standards Magazine, Series Editor, Wireless and Radio Communications, 2017-

Committee Membership:
- IEEE 802.11 Working Group Voting Member, 2001-2003, 2006-present
- IEEE 802.15 Working Group Voting Member 1999-2001
- Chairman, IEEE Standards in Education Committee, 2006 – present
- Member of the Editorial Board, Journal of Networks.
- 2004-2005 Chairman and 2003-2004 Secretary of the Oakland/East Bay Chapter of the IEEE Communication Society.

Program Committee Membership:
- General Chair, Tactical Communications and Interoperability Conference, 2011
- General Chair, Fort Wayne Wireless Summer School 2009 and 2010
- Program Committee Member, Int. Conf. on Wireless Applications and Computing, 2007.
- Program Committee Member, Int. Conference on WLAN, WPAN, and WMAN, Hawaii, Aug. 2007.

- Program Committee Member, Int. Joint Conf. e-Business and Telecommunications, Barcelona, Spain, 2007.
- Program Committee Member, Int. Conf. Wireless Information Networks and Systems, Lisbon, Portugal, 2006.
- Technical Program Committee Member, Int. Conf. Networking and Services, ICNS 2006, Santa Clara, CA.
- Technical Program Committee Member, Advanced Int. Conference on Telecommunications, AICT, Guadeloupe, French Caribbean 2006.
- Program Committee Member, Int. Joint Conf. e-Business and Telecommunications, Reading, UK, 2005.
- Technical Program Committee Member, Int. Conf. Convergent Services and Next-Generation Networks, June 2005, Chicago, IL.
- Technical Program Committee Member, Int. Conference on Service Assurance with Partial and Intermittent Resources, Lisbon, Portugal, July 2005.
- Technical Program Committee Member, Int. Conf. Telecommunications, 2004, Brazil.
- 3rd Int. Workshop on Signal and Image Processing, Manchester, UK, Special session on wavelets in communication systems, signal and image processing, special session co-organizer, Nov. 1996.

Tutorials at International Conferences

1) T. Cooklev, "Open RF-digital interfaces and wireless ontologies," IEEE BlackSeaCom, 4th International Black Sea Conference on Communications and Networking, Varna, Bulgaria, June 2016.
2) M. Cummings, T. Cooklev, "Software Defined Radio Technology", Tutorial at the 2008 Symposium System on Chip, Tampere, Finland, Nov. 2008.
3) M. Cummings, T. Cooklev, "Software Defined Radio Technology", Tutorial at the IASTED Int. Conference Computer Communications, Palma de Mallorca, Spain, Sept. 2008.
4) M. Cummings, T. Cooklev, "Software Defined Radio Technology", Tutorial at the 2007 International Conference on Computer Design, Squaw Creek, CA 2007.
5) T. Cooklev, "Wireless communication standards: 802.11, 802.15, and 802.16," Int. Conference Telecommunications, Fortaleza, Brazil, Aug. 2004, tutorial.
6) T. Cooklev, "Wireless data communication standards, IEEE Globecom 2003, Dec. 2003, San Francisco, CA, tutorial.

Short Courses and Invited Talks excluding conferences:

1) T. Cooklev, "Open RAN", Technical University of Sofia, Bulgaria, November 2019.
2) T. Cooklev, "Software-defined radio technology," Oulu University, Finland, Oct. 2017.
3) T. Cooklev, "Software-defined radio technology," Aarhus University, Denmark, Oct. 2017.
4) T. Cooklev, "Modern wireless systems," Technical University of Sofia, Bulgaria, 2014.
5) T. Cooklev, "Modern Wireless Systems," Featured faculty presentation, Feb. 2012, IPFW.
6) T. Cooklev, "Software-defined radio technology," Tokyo Institute of Technology, Dec. 2011.
7) T. Cooklev, "Software-defined radio technology," University of Akron, OH, 2010.
8) T. Cooklev, "Modern wireless systems," Catholic University of Leuven, Leuven. Belgium, 2010
9) T. Cooklev, "Modern wireless systems," University of Qatar, Doha, Qatar, 2009.
10) T. Cooklev, "Modern wireless systems," Technical University of Sofia, Bulgaria, 2009.

11) T. Cooklev, “Modern wireless systems: from Marconi’s radio to cognitive radio,” Sigma Xi presentation, February 2009, IPFW.
12) T. Cooklev “Software-Defined Radio Technology,” Talk at IPFW, Oct. 2008.
13) M. Cummings, T. Cooklev, “Software Defined Radio Technology”, IEEE Communication Society, Oakland/East Bay Chapter, presentation, Oct. 2007, San Ramon, CA.
14) T. Cooklev, “Engineering Standards in Engineering Education,” presentation and a panel participant, Standards Engineering Society Annual Conference, San Francisco, CA, August. 2007. (panelist and presenter)
15) T. Cooklev, “Vector transform for multicarrier modulation”, France Telecom, June 2007, Rennes, France.
16) T. Cooklev, “Wireless Communication Standards,” Distinguished Lecture, IEEE Communication Society, Oct. 2006, University of Maine.
17) T. Cooklev, “The IEEE 802.11, 802.15, and 802.16 Families of Standards,” Short Course, April 2006, Lietuvos Telekomas, Vilnius, Lithuania,
18) T. Cooklev, “The IEEE 802.11, 802.15, and 802.16 Families of Standards,” Short Course, Feb. 2006, Austin, TX.
19) T. Cooklev, “The IEEE 802.11, 802.15, and 802.16 Families of Standards,” Invited Talk, Dec. 2005, Cisco Systems, San Jose, CA.
20) Wireless local area networks, Hitachi Ltd., Brisbane, CA, June 2005.
21) T. Cooklev, “The IEEE 802.11, 802.15, and 802.16 Families of Standards,” Invited Talk, May 2005, Texas Instruments, Dallas, TX.
22) T. Cooklev, “Standards for the Wireless Internet”, IEEE Communication Society, Oakland/East Bay Chapter, presentation, January 2005. Freemont, CA.
23) T. Cooklev, “Wireless data communication standards, IEEE Wescon, Aug. 2003, San Francisco, CA, tutorial.
24) Short Course on 802.11, 802.15, 802.16, West Long Branch, NJ, August 2003
25) Wireless data communication standards, Lockheed Palo Alto Research Center, June 5, 2003.
26) Short Course on IEEE 802.11, 802.15, and 802.16, San Francisco, CA, Dec. 2002.
27) Standards for wireless data communications, University of Utah, Salt Lake City, UT, 1999
28) OFDM for wireless communications, 3Com Technology Forum, Boston, MA, Nov. 1998.
29) Filter banks and wavelets: a modern applied mathematics tool, Invited Lecture at the Analysis Day, Department of Mathematics and Statistics, Carleton University, Ottawa, Canada, 1997
30) Filter banks and wavelets for video signal processing, Genesis Microchip Inc, Markham, Ontario, Canada, July 1996.
31) Advanced topics in filter banks, wavelets, and their applications in modern communications systems, CRC, Ottawa, March and August 1996.
32) Digital filter banks and wavelets, Dept. Elect. Eng., University of Ottawa, March 1996.
33) Digital filter banks and wavelets, Dept. Elect. Eng., Queen's University, Kingston, March 1996.
34) Perfect-reconstruction filter banks and wavelet bases and their applications in digital communications, Fujitsu Laboratories, Kawasaki, Japan, July 1994.
35) Fast algorithms for signal processing, Istanbul University, Istanbul, Turkey, Jan. 1994.

Publications

Books and Monographs

1) T. Cooklev, W*ireless communications standards: A Study of IEEE 802.11, 802.15, 802.16*, IEEE Press, New York, NY. 2004.

Chapters in Books

1) A. Vlahov, D. Elkova, V. Poulkov, T. Cooklev, Virtualized, open, and intelligent: the evolution of the Radio Access Network," River Publishers, 2021.

2) Subbu Ponnuswamy, Todor Cooklev, Yang Xiao, and Krishna Sumanth Velidi, "Security in fixed and mobile IEEE 802.16 networks," Chapter 4, *WiMAX/MobileFi: Advanced Research and Technology*, edited by Yang Xiao, Taylor and Francis, January 2008.

3) T. Cooklev and A. Hristozov, "The Software Communications Architecture," in *Resource Management in Future Internet*, edited by Ramjee Prasad, River Publishers, Denmark, 2015.

Journal Papers

1) V. Kolev, T. Cooklev, F. Keinert, *Design of a Simple Orthogonal Multiwavelet Filter by Matrix Spectral Factorization*, Circuits, Systems, and Signal Processing, 2019.

2) Y. Acar and T. Cooklev, "High performance OFDM with index modulation", *Physical Communication*, vol. 32, pp. 192-199, 2019.

3) M. Sherman and T. Cooklev, "Abstract descriptions of spectrum: VITA 49 and IEEE 1900.5.2", *IEEE Communications Standards Magazine*, vol. 2, no. 4, pp. 43-48, December 2018.

4) T. Cooklev, V. Poulkov, D. Bennett, K. Tonchev, "Enabling RF data analytics services and applications via cloudification," *IEEE Aerospace Electronic Systems Magazine*, vol. 33, no. 5-6, pp. 44-55, May-June 2018.

5) V. Kolev, T. Cooklev, F. Keinert, "Matrix spectral factorization for the SA4 multiwavelet," *Journal of Multidimensional Systems and Signal Processing*, vol.29, Issue 4, pp 1613–1641, 2018.

6) H. Dogan, T. Cooklev, and J. Darabi, "Improved low-complexity zero-padded OFDM receivers", *Digital Signal Processing*, vol. 51, pp. 92–100, April 2016.

7) P. Baltiiski, I. Iliev, B. Kehaiov, V. Poulkov, and T. Cooklev, "Long-Term Spectrum Monitoring with Big Data Analysis and Machine Learning for Cloud-Based Radio Access Networks," *Wireless Personal Communications*, vol. 87, issue 3, pp. 815-835, April 2016.

8) T. Cooklev, J. Darabi, C. McIntosh, and M. Mosaheb, "Cloud-based approach for spectrum monitoring," *IEEE Instrumentation and Measurement Magazine*, vol. 18, no. 2, pp. 33-37, April 2015.

9) Sven Bilen, A. Wyglinski, C. Anderson, T. Cooklev, C. Dietrich, B. Farhang-Boroujeny, "On Software-Defined Radio as an integrative educational resource," *IEEE Communications Magazine*, vol. 52, no. 5, pp. 184-193, May 2014.

10) Hakan Yıldız, Yusuf Acar, Todor Cooklev, Hakan Dogan, "Generalized Prefix for Space-Time Block Coded OFDM Wireless Systems over Correlated MIMO Channels," *IET Communications*, vol. 8, no. 9, pp. 1589-1598, June 2014.

11) T. Cooklev, A. Nishihara, "An Open RF-Digital interface for software-defined radios," *IEEE Micro,* vol. 33, no. 6, pp. 47-55, Dec. 2013.

12) T. Cooklev, R. Normoyle, and D. Clendenen, "The VITA 49 RF-digital interface," *IEEE Circuits Systems Magazine*, vol. 12, no. 4, pp. 21-32, Dec. 2012.

13) T. Cooklev, "An improved prefix for OFDM-based cognitive radios", *Electron. Lett.*, vol. 48, No. 4, Feb. 2012.

14) Y. Alqudah and T. Cooklev, "Hands-on open access broadband wireless technology lab", *Int. J. Interactive Mobile Tech.*, Vol. 6, No 4, 2012, pp. 13-18.

15) T. Cooklev, H. Dogan, R. Cintra, H. Yildiz, "Generalized prefix for OFDM wireless systems over quasi-static channels," *IEEE Transactions on Vehicular Technology,* vol. 60, No. 8, pp. 3684 – 3693, *Nov.* 2011.

16) F. Ramirez-Mireles, T. Cooklev, and G. A. Paredes-Orozco, "UWB-FSK: Performance tradeoffs for high-complexity receivers," *IEEE Transactions on Consumer Electronics*, vol. 56, no. 4, pp. 2123-2131, 2010.

17) S. Hossain, D. Batovski, and T. Cooklev, "Eight-channel transmultiplexer with binary matrix sequences," *Assumption Univ. Journal of Technology (Thailand),* vol. 13, No. 4, pp. 193-202, 2010.

18) T. Cooklev, "Engineering standards and engineering education," *Journal of IT Standardization Research*, vol. 8, 2010, pp. 1-10.

19) R. Cintra and T. Cooklev, "Robust image watermarking using non-regular wavelets," *Journal of Signal, Image, and Video Processing*, 2008.

20) T. Cooklev, A. Pakdaman, J. Eidson, "IEEE 1588 over IEEE 802.11 for synchronization of wireless local area nodes," *IEEE Trans. Instrumentation and Measurement*, vol. 56, No. 5, pp. 1632-1639, Oct. 2007.

21) T. Cooklev and A. Nishihara, "Analytic constructions of complementary sequences," *IEICE Trans. Fundamentals*, November 2006.

22) T. Cooklev, "An efficient architecture for orthogonal wavelet transforms," *IEEE Signal Processing Letters*, Feb. 2006.

23) T. Cooklev, “Standards for the wireless Internet,” *Annual review of communications*, vol. 57, Dec. 2004.

24) T. Cooklev, G. Berbecel and A. N. Venetsanopoulos, ``Wavelets and differential-dilation equations,’’ *IEEE Trans. Signal Processing*, vol. 48, pp. 2258-2268, 2000.

25) T. Cooklev and A. Nishihara, “Biorthogonal coiflets,”*IEEE Trans. Signal Processing*, vol. 47, pp. 2582-2588, 1999.

26) T. Cooklev, A. Nishihara, T. Yoshida, and M. Sablatash, ``Multidimensional two-channel linear phase FIR filter banks and wavelet bases with vanishing moments," *Journal of Multimensional Systems and Signal Processing*, vol. 9, pp. 39-76, January 1998.

27) T. Cooklev, A. Nishihara and M. Sablatash ``Regular orthonormal and biorthogonal wavelet filters," *Signal Processing*, vol. 57, pp. 121-137, Feb. 1997.

28) T. Yoshida, T. Cooklev, A. Nishihara, and N. Fujii, "Design of non-separable 3-D QMF banks using McClellan transformations," *IEICE Trans. Fundamentals*, vol. E79-A, No. 5, May 1996, pp. 716-720.

29) M. Sablatash and T. Cooklev ``Coding of high-quality audio signals by wavelets and wavelet packets," *Digital Signal Processing: A Review Journal*, vol. 6, No. 2, pp. 96-107, April 1996.

30) V. Dimitrov, T. Cooklev, and B. Donevsky ``Number-theoretic transforms over the golden-section quadratic field," *IEEE Trans. Signal Processing*, No. 8, pp. 1790-1797, August 1995.

31) V. Dimitrov and T. Cooklev, ``Hybrid algorithm for computing the matrix polynomial," *IEEE Trans. Circuits Syst.*, No. 7, pp. 377-380, July 1995.

32) V. Dimitrov and T. Cooklev ``Two algorithms for modular exponentiation based on nonstandard arithmetics,’’ Special issue on cryptography and information security, *IEICE Transactions on Fundamentals*, Jan. 1995.

33) M. Sablatash , Todor Cooklev and Takuro Kida,``The coding of image sequences by wavelets, wavelet packets and adaptive wavelet packets," *IEEE Trans. Broadcasting*, Dec. 1994.

34) T. Cooklev and A. Nishihara, ``Partial and generalized FFT," *IEICE Trans. on Fundamentals*, Sept. 1994.

35) V. Dimitrov, T. Cooklev and B. Donevsky, "Generalized Fermat-Mersenne number theoretic transforms," *IEEE Trans. Circuits Syst.,* vol. 41, pp. 133-139, Feb. 1994.

36) T. Cooklev, T. Yoshida and A. Nishihara, ``Maximally flat half-band diamond-shaped FIR filters using the Bernstein polynomial," *IEEE Trans. Circuits Syst.,* vol. 40, pp. 749-751, Nov. 1993.

37) T. Cooklev and A. Nishihara, ``Maximally flat FIR Hilbert transformers," *Int. Journal Circuit Theory and Applications*, vol. 21, pp. 563-570, 1993.

38) T. Cooklev, S. Samadi, A. Nishihara and N. Fujii, Efficient implementation of all maximally flat FIR filters of a given order," *Electronics Lett.,* vol. 29, No. 7, pp. 598-599, 1993.

39) S. Samadi, T. Cooklev, A. Nishihara and N. Fujii, ``Multiplierless structure for maximally flat linear phase FIR filters," *Electronics Lett.,* vol. 29, No. 2, pp. 184-185, 1993.

40) V. Dimitrov, T. Cooklev and B. Donevsky, "Generalized Fermat number transforms," *ASME Journal on Numerical Modeling*, 1992, N. 4 pp. 11-22.

41) T. Cooklev, V. Dimitrov and B. Donevsky, "Systolic implementation of the complex Chebyshev structure," *Int. J. Electronics*, vol. 73, pp. 1247-1252, Dec. 1992.

42) T. Cooklev and A. Nishihara, "Efficient design of N--D hyperspherically symmetric FIR filters," *IEICE Transactions on Fundamentals of Electronics, Inform. and Comput. Sci.*, vol. E75-A, pp. 1739-1742. Dec. 1992.

43) T. Cooklev, V. Dimitrov and B. Donevsky, "An improved systolic implementation of complex digital filters," *Archiv fuer Elektronik und Uebertragungstechnik (Germany)*, vol. 46, pp. 434-436, Nov.-Dec. 1992.

44) V. Dimitrov, T. Cooklev and B. Donevsky, "On the multiplication of reduced biquaternions and applications," *Information Processing Letters,* vol. 43, pp. 161-164, Sept. 1992.

Conference Papers

45) Plamen Semov*, Pavlina Koleva*, Vladimir Poulkov*, and Todor Cooklev, "Evolution of Mobile Networks and C-RAN on the Road Beyond 5G," 43rd Int. Conf. on Telecommunications and Signal Processing, Milan, Italy, July 2020.

46) Y. Acar, S. Colak, T. Cooklev, "Dual-Mode Index Modulation Aided OFDM with Generalized Prefix", *Int. Symp. Networks, Computers, and Communications*, June 2019, Istanbul, Turkey.

47) T. Cooklev, "Making Software Defined Networks Semantic," *Proc. WINSYS*, July 2015, Colmar, France.

48) T. Cooklev, L. Stanchev, "A comprehensive and hierarchical ontology for wireless systems," *Wireless World Research Forum*, Marrakech, Morocco, May 2014.

49) Yusuf Acar, H. Yildiz, H. Dogan, and H. Dogan, "Generalized Prefix Approach for Alamouti Coded OFDM Systems over Gaussian Channels Correlated in Space," IEEE 2014 World Congress on Computer Applications and Information Systems (WCCAIS), Hammamet, Tunisia, January17-19, 2014.

50) Yusuf Acar, H. Yildiz, H. Dogan, and H. Dogan, "Performance Improvement for Correlated 4x4 MIMO-OFDM Systems by Generalized Prefix Approach," 2013 Int. Conference on Signal Processing and Communications, Dec. 12-14, Noida, Uttar Pradesh, India.

51) T. Cooklev, L. Stanchev, C. Chen, "Wireless cloud architecture based on thin clients and ontologies," *Proc. IEEE Midwest Symp. Circuits and Systems*, Columbus, OH, Aug. 2013

52) Acar, Y.; Yildiz, H.; Cooklev, T.; Dogan, H., "High-performance MIMO OFDM wireless systems with generalized prefix," *21st Signal Processing and Communications Applications Conference (SIU), 2013*, 24-26 April 2013, North Cyprus.

53) Dogan, H. Yildiz, T. Cooklev, Y. Acar, "Coded OFDM wireless systems with generalized prefix", Int. Conf. on Application of Information and Communication Technologies, Tbilisi, Georgia, Oct. 2012.

54) A. Madanayake, C. Wijenayake, Nghi Tran, T. Cooklev, Sean V Hum, L. T. Bruton, "Directional Spectrum Sensing using Tunable Multi-D Space-Time Discrete Filters," First IEEE International Workshop on Emerging COgnitive Radio Applications and aLgorithms (IEEE CORAL), San Francisco, CA June 2012.

55) Yazan A. Alqudah and T. Cooklev, Hands-On Open Access Broadband Wireless Technology Lab, *Proc. IEEE Global Engineering Education Conference (IEEE EDUCON),* Marrakech, Morocco, April 2012.

56) Yazan A. Alqudah and T. Cooklev, Hands-On Open Access Broadband Wireless Technology Lab, ASEE Illinois/Indiana Section Conference, Valparaiso, IN, March 2012.

57) D. Mueller, T. Cooklev, H. Oloomi, C. Pomalaza-Ráez, and S. Walter, "A Graduate Program In Wireless Technology And Systems Engineering: Overview And Initial Experiences", ASEE Illinois/Indiana Section Conference, Valparaiso, IN, March 2012.

58) L. Stanchev and T. Cooklev, "Describing Radio Hardware and Software Using OWL for Over-The-Air Software Download," SDR Forum Tech. Conference, Washington, DC, Dec. 2010.

59) A. Marcum, T. Cooklev, and Carlos Pomalaza-Raez, "Simple OFDM," Virginia Tech Wireless Summer School, June 2010.

60) C. Chen, Z. Chen, T. Cooklev, and C. Pomalaza-Raez, "On spectrum probing in cognitive radio networks: does randomization matter," IEEE Int. Conf. Communications, May 2010.

61) Z. Chen, T. Cooklev, C. Chen, and Carlos Pomalaza-Raez, "Modeling primary user emulation attacks and defenses in cognitive radio networks," Int. Performance Computing and Communications Conference, Dec. 2009, Phoenix, AZ

62) T. Cooklev and M. Cummings, "Changing metalanguage landscape," SDR Forum Technical Conference, Washington, DC, Dec. 2009.

63) F. Ramirez-Mireles, T. Cooklev, and M. Sablatash, "Analysis of filter-based non-coherent detection of UWB FSK with antenna and multipath effects," IEEE MILCOM 2008.

64) T. Cooklev and M. Cummings, "Networking description language for ubiquitous cognitive networking," SDR Forum Technical Conference, Washington, DC, Nov. 2008.

65) M. Cummings, T. Cooklev, B. Lyles, P. A. Subrahmanyam, "Commercial wireless metalanguage scenario," Software Defined Radio Technical Conference, Denver, CO, November 2007.

66) T. Cooklev and A. Abedi, "Teaching the IEEE wireless communication standards dynamically," 2007 Frontiers in Education Conference, Milwaukee, WI, Oct. 10-13, 2007.

67) S. Gaur and T. Cooklev, "Using Finer AIFSN granularity to Accurately Tune the Flow Ratios in IEEE 802.11e," The 18th Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), Sept. 2007, Athens, Greece.

68) S. Gaur and T. Cooklev, ""Performance Enhancement of IEEE 802.11e EDCA by Random AIFSN", 2007 3rd International Conference on Testbeds and Research Infrastructures for the Development of Networks & Communities (TridentCom), Grosvenor Resort, Orlando, FL, May 21-23, 2007.

69) F. Ramirez-Mireles, and T. Cooklev, "Effects of Antenna and Multipath Frequency Selectivity on UWB Using Non-coherent FSK," World Wireless Forum, Stanford, CA, May18-20 2007.

70) F. Ramirez-Mireles, and T. Cooklev, "An Investigation of Antenna and Multipath Effects on Pulse-Based UWB Using FSK," IEEE Globecom, San Francisco 2006.

71) T. Cooklev and P. Siohan "Vector-transform-based OFDM", Asilomar Conf. On Computers and Comm., Pacific Grove, Nov. 2006.

72) S. Gaur and Cooklev, T. "Performance enhancement of IEEE 802.11e EDCA by random AIFSN," IEEE Wireless multimedia communication conf., Vancouver, BC, Canada, July 2006.

73) T. Cooklev, Keh-Gang Lu "A wavelet transform approach to the design of complementary sequences for communications, 39th Asilomar Conference on Systems, Signals, and Computers, Pacific Grove, CA Nov. 2005.

74) M. Goins, T. Cooklev, and J. W. Hines, "System-on-a-chip design for lab-on-a-chip in space-flight systems," Proc. Information Systems: New Generations, Las Vegas, NV, April 2005.

75) Y. Bai and T. Cooklev, "An improved method for lossless data compression" IEEE Data Compression Conference, Snowbird, Utah, March 2005.

76) A. Pakdaman, J. Eidson, T. Cooklev, "Synchronization of wireless LAN over IEEE 1588," Int. Conference on IEEE 1588, Baltimore MD, Sept. 2004.

77) T. Cooklev, “Dynamic bandwidth allocation and channel coding for providing QoS in wireless networks,” Int. Conference on Telecommunications, Feb. 2003, Papeete, Tahiti.

78) T. Cooklev and M. Sablatash ``A wavelet transform approach to the design of sequences for communications," Wireless Communications'97, Calgary, July 1997.

79) M. Sablatash, John Lodge, and T. Cooklev ``Transmitter and receiver filter bank designs for bandwidth-on-demand multiple access communications combining wavelet packet filter bank trees and DFT polyphase filter banks" IEEE Int. Conference on Communications, Montreal, 1997.

80) G. Berbecel, T. Cooklev and A. N. Venetsanopoulos, ``A practical wavelet-based approaches to watermarking digital images," IEEE Conf. on Consumer Electronics, Chicago, IL, 1997.

81) T. Cooklev, G. Berbecel, A. N. Venetsanopoulos, ``Wavelets and differential-dilation equations" Canadian Workshop on Information Theory, Toronto, June 1997.

82) T. Cooklev, G. Berbecel, and A. N. Venetsanopoulos, ``Construction of an infinitely differentiable continuous-time wavelet and differential dilations equations," Int. Workshop on Signal and Image Processing, Manchester, UK, Nov. 1996.

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Expert witness experience

2021 – Expert for WSOU Investments, LLC d/b/a Brazos Licensing and Development
- Law firm: Kasowitz Benson Torres LLP
- Case name: *WSOU Investments, LLC d/b/a Brazos Licensing and Development v. Canon, Inc*.,
- Case Nos. 6:20-cv-00980-ADA, 6:20-cv-00981-ADA, 6:20-cv-00982-ADA (W.D. Tex.)

2021 – Expert for WSOU Investments, LLC d/b/a Brazos Licensing and Development
- Law firm: Kasowitz Benson Torres LLP
- Case name: *WSOU Investments, LLC d/b/a Brazos Licensing and Development v. OnePlus Technology (Shenzhen) Co., Ltd.,*
- Case Nos. 6:20-cv-00952-ADA, 6:20-cv-00953-ADA, 6:20-cv-00956-ADA, 6:20-cv-00957-ADA, 6:20-cv-00958-ADA (W.D. Tex.)

2021 – Expert for Barkan Wireless IP Holdings, L.P.
- Law firm: Heim, Payne & Chorush, LLP, Houston, TX
- Case name: *Barkan Wireless* v. *T-Mobile, Inc. and Nokia of America Corp.*
- Civil Action No. *2:21-CV-00034-JRG (E. D. Tex.)*

2019 – Expert for UNM Rainforest Innovations of the University of New Mexico
- Law firm: Shore Chan DePumpo LLP, Dallas, TX
- Case name: *UNM Rainforest Innovations* v. *Dell*
- Civil Action No. *6:20-CV-00468-ADA (W. D. Tex.)*

2020 – 2021 Expert for *General Access Solutions,* Dallas, TX
- Law firm: Bartlit Beck, Denver, CO
- Case name*: General Access Solutions, LTD. v. Sprint*
- Civil Action *No. 2:20-cv-00007-RWS (E. D. Tex.)*

2014 – Expert for *TQ Delta,* Austin, TX
- Law firm: McAndrews, Chicago, IL
- Case name: TQ Delta v. Adtran
- Civil Action *No. 14-cv-00954-RGA (D-Del.)*
- Civil Action *No. 15-cv-00121-RGA* (*D-Del.*)

2014 – Expert for *TQ Delta,* Austin, TX
- Law firm: McAndrews, Chicago, IL
- Case name: TQ Delta v. 2Wire
- Civil Action *No. 13-cv-1835-RGA (D-Del.)*

2014 – Expert for *TQ Delta,* Austin, TX
- Law firm: McAndrews, Chicago, IL
- Case name: TQ Delta v. Zhone
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2014 – Expert for *TQ Delta,* Austin, TX
- Law firm: McAndrews, Chicago, IL
- Case name: TQ Delta v. Zyxel
- Civil Action *No. 13-cv-2013-RGA (D-Del.)*

2015 – 2019 Expert for *Evolved Wireless,* Austin, TX
- Law firm: Robins Kaplan, Minneapolis, MN
- Civil Actions *No. 15-cv-542-SLR-SRF, No. 15-cv-543-SLR-SRF, No. 15-cv-544-SLR-SRF, No. 15-cv-545-SLR-SRF, No. 15-cv-546-SLR-SRF*, and *No. 15-cv-547-SLR-SRF (D-Del.)* brought against Apple, HTC, Lenovo, Samsung, ZTE, and Microsoft.

2018 –2018 Expert
- Law firm: McKool Smith, Dallas, TX

2013 – 2015 Expert, *Inter-Digital*
- Law firm: Latham and Watkins, Chicago, IL and San Francisco, CA
- Case name: Inter-Digital v. ZTE; Inter-Digital v. Nokia (Microsoft Mobile Oy)
- Civil Actions *No. 13-cv-00009-RGA* and *No. 13-cv-00010-RGA (D-Del.)* brought against ZTE and Microsoft Mobile Oy.

2014 – 2015 Expert, *Core Wireless Licensing, S.à.r.l.*
- Law firm: Bunsow, De Mory, Smith, and Allison, San Francisco, CA
- Civil Actions *No. 6:14-cv-752, No. 2:14-cv-911*, and *No. 2:14-cv-912 (E.D. Tex.)* brought against Apple, Inc. and LG Electronics, Inc.

2014 – 2015 Expert, *Intellectual Ventures I LLC and Intellectual Ventures II LLC*
- Law firm: Dechert, Mountain View, California
- Civil Actions *Nos. 13-cv-01668-LPS, 13-cv-01671-LPS, 13-cv-01670-LPS, 13-cv-01672-LPS, 13-cv-01669-LPS, 14-cv-01229-LPS, 14-cv-01230-LPS, 14-cv-01231-LPS, 14-cv-01232-LPS, 14-cv-01233-LPS*, brought against various AT&T, T-Mobile, Sprint, U.S. Cellular, and Cricket defendants.

2008 – 2010 Expert, *Intel, Santa Clara, CA*
- Law firm: Kirkland & Ellis, San Francisco, CA,

2007 – 2008 Expert, *Intel, Santa Clara, CA*
- Law firm: Keker & Van Nest, San Francisco, CA